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**Date:** September 2, 2016  
**To:** Joseph Ebert, AFCEC COR  
**CC:** Don Gronstal, AFCEC; Calvin Cox, CNGS; and Susan Soloyanis, Sologeo  
**From:** Christopher Terpolilli, CB&I Federal Services, LLC.  
**Subject:** Former George AFB - Fall 2016 Basewide Groundwater Sampling Event

The Fall 2016 groundwater monitoring event is scheduled to begin September 26, and will include gauging the depth-to-water (and depth-to-product if present) for all groundwater monitoring and extraction wells and analyzing groundwater samples from selected wells for volatile organic compounds (VOCs), general chemistry, and total dissolved solids (TDS). The methods and analytical suites for groundwater sampling are provided in the Draft UFP QAPP (Shaw, 2012a). The list of monitoring wells to be sampled is provided as Table 1.

The overall objectives of this groundwater monitoring event are to:

- Verify compliance with the OU1 ROD (CG070)
- Verify plume stability and product distribution in support of the PSCAP (SS030 and ST067b)
- Monitor seasonal variation in groundwater elevation and flow patterns
- Monitor concentrations and areal extent of contaminants of concern (COCs), and
- Collect baseline samples of newly installed OT071 wells (MW-159 through MW-163)

AMR sampling is divided into two separate events: OU1 sampling (Fall) and non-OU1 sampling (Spring); except where specified within RODs/LTMPs. As such, Site CG070 constitutes the bulk of the Fall groundwater sampling. There are however, an additional four sites associated with sampling during this Fall 2016 basewide groundwater monitoring event: ST067b, OT071, LF012, and LF044. Table 1 includes the well identification, aquifer, screen depth, previous depth to water, proposed pump placement, associated site(s), analysis to be performed and rationale for sampling in Fall 2016. Note that some of the wells are used to monitor multiple plumes and the data collected will be used for reporting on more than one site. As such, the summation of the well totals listed in the site sections below will not equal the cumulative basewide total listed in the final section (Conclusion) of this Tech Memo. A detailed well total, including associated sites, can be found in Table 1.

**OT069.** Site OT069 is a chlorinated VOC groundwater plume present in the Upper Aquifer beneath the flight line area that is part of OU3. The LTMP for Site OT069 entails annual sampling (typically during Spring) to monitor the chlorinated solvent plume. Although Table 1 indicates four (4) wells are scheduled for Fall sampling at OT069, note that these are “shared” wells and are being sampled for other sites (SS030, OT071, and ST067b). See Table 1 for detailed site breakdown and list of analyses.

**SS030.** Site SS030 is a non-CERCLA site that contains a freeproduct and a dissolved-phase petroleum hydrocarbon plume present in the Upper Aquifer beneath the flightline area. Monitoring wells associated with the SS030 site will not be sampled for dissolved constituents if free product is observed while gauging the depth-to-water. No wells are proposed for sampling at SS030 during the upcoming Fall 2016 event.

**SS084.** Groundwater monitoring beneath non-CERCLA Site SS084 is intended to monitor the effectiveness of vadose zone remediation at reducing benzene and MTBE concentrations reaching groundwater. Due to the nature of the site, groundwater monitoring is addressed under SS030 and sampled annually during the Spring event. As such, there are no wells proposed for sampling at SS084 during the upcoming Fall 2016 event.

**ST067b.** Site ST067b is a non-CERCLA site that contains a free product and a dissolved-phase JP-4 plume present in the Upper Aquifer and is located in the southwestern portion of the Base. Monitoring wells associated with the ST067b site will not be sampled for dissolved constituents if free product is observed while gauging the depth-to-water. As outlined in Table 1, a total of thirty-five (35) wells are proposed for sampling at ST067b during the Fall 2016 event. Note that a portion of these wells are also shared with sites OT069 and OT071 (see Table 1 for detailed site breakdown and list of analyses).

**OT071.** Site OT071 is a non-CERCLA, dieldrin groundwater plume in both the Upper and Lower Aquifers and is located in the southeast portion of the Base. As outlined in Table 1, a total of twenty-nine (29) wells are proposed for sampling at OT071 during the Fall 2016 event. Note that a portion of these wells are also used to monitor sites ST067b, OT071, and LF012 (see Table 1 for detailed site breakdown and list of analyses).

**ZZ051.** Site ZZ051 contains petroleum COCs in groundwater and is located in the Upper Aquifer along the western portion of the Base (part of OU3). Groundwater associated with ZZ051 is currently sampled annually during the Spring event. As such, there are no wells proposed for sampling at ZZ051, during the upcoming Fall 2016 event.

**DP003.** Site DP003 was a suspected acid and oil burial site located approximately 400 feet north of the northeast end of Runway 3/21. Groundwater monitoring for this landfill is currently being performed

once every 5 years, in accordance with the Landfill LTMMP. Note that the last groundwater monitoring event was conducted in Spring 2014, and the next event will be in Spring 2019.

**DP004.** Site DP004 is a reported pesticide and oil burial site located about 200 feet east of the northeast end of Runway 3/21. As with Site DP003, groundwater monitoring for this landfill is currently being performed once every 5 years, in accordance with the Landfill LTMMP. Note that the last groundwater monitoring event was conducted in Spring 2014, and the next event will be in Spring 2019.

**LF012.** Site LF012 is an abandoned landfill covering approximately 12 acres on the eastern side of the Base and is part of OU3. Groundwater associated with LF012 is currently sampled annually during the Spring event and analyzed for VOCs, chloride, nitrate, sulfate, and total dissolved solids. As outlined in Table 1, one (1) well is proposed for sampling at LF012, during the upcoming Fall 2016 event. Note that this well is also used to monitor Site OT071.

**LF014.** Site LF014 is a landfill covering approximately 50 acres in the northeastern portion of the Base and is part of OU3. Groundwater associated with LF014 is currently sampled annually during the Spring event. As such, there are no wells proposed for sampling at LF014, during the Fall 2016 event.

**LF044.** Site LF044 is an abandoned landfill covering approximately 0.5 acres in the northeastern portion of the Base and is part of OU3. Groundwater associated with LF044 is currently sampled annually during the Spring sampling event. Although Table 1 indicates that one (1) well is scheduled for Fall sampling at LF044, this is a “shared” well and is being sampled under CG070 (see Table 1 for detailed site breakdown and list of analyses).

**FT019.** Site FT019 consists of fire-training areas located northwest of Runway 3/21 and includes two active subsites: FT019a and FT019c. Note that groundwater beneath FT019 is part of OU1 and is sampled under Site CG070 during the annual Fall event. As such, all three (3) Site FT019 wells (FT-03, FT-04, and FT-05) are listed under Site CG070 in Table 1.

**CG070.** Site CG070 consists of a TCE groundwater plume present in the Upper and Lower Aquifers in the northeastern portion of the former George AFB and is part of OU1. As outlined in Table 1, a total of eighty-eight (88) wells are proposed for sampling at CG070 during the Fall 2016 event. Note that one well is also used to monitor LF014 and LF044 (see Table 1 for detailed site breakdown and list of analyses).

**Fall 2015 Variations.** Basewide locations that were sampled in Fall 2015, but will not be sampled in Fall 2016, are listed below:

- EX-01 (SS030): added for a single event in Fall 2015.
- EX-10 (SS030): added for a single event in Fall 2015.

- MW-28 (OT069b/SS030): LTMP trigger well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-30 (OT069c/SS030): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-31 (OT069b/SS030): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-34 (OT069c/SS030): LTMP trigger well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-35 (OT069b/SS030): Five-Year Review, LTMP trigger well to be moved to Spring sampling/Five-Year rotation with other non-OU1 wells
- MW-36 (OT069b/SS030): Five-Year Review, LTMP trigger well to be moved to Spring sampling/Five-Year rotation with other non-OU1 wells
- MW-43 (OT069e/SS030): LTMP trigger well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-44 (OT069e): Five-Year Review, LTMP trigger well to be moved to Spring sampling/Five-Year rotation with other non-OU1 wells
- MW-45 (OT069b): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-48 (OT069e): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-52 (OT069): to be moved to Spring sampling rotation with other non-OU1 wells
- MW-54 (SS030): added for a single event in Fall 2015.
- MW-55 (SS030): added for a single event in Fall 2015. Typically sampled during Spring rotation
- MW-57 (OT069c/SS030): LTMP trigger well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-58 (OT069c): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-65 (SS030): added for a single event in Fall 2015.

- MW-71 (OT069c): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-74 (OT069e): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-75 (OT069e): annual, LTMP trigger well to be moved to Spring sampling rotation with other non-OU1 wells
- MW-86 (SS030): added for a single event in Fall 2015. Typically sampled during Spring rotation
- MW-91 (OT069c/SS030): annual, LTMP well to be moved to Spring sampling rotation with other non-OU1 wells
- NZ-63 (OT071): added for a single event in Fall 2015. Typically sampled during Spring rotation
- NZ-81 (CG070): Consistently insufficient water for sampling
- NZ-89 (OT071): added for a single event in Fall 2015. Typically sampled during Spring rotation
- NZ-120 (OT071): added for a single event in Fall 2015. Typically sampled during Spring rotation
- NZ-122 (OT071): added for a single event in Fall 2015. Typically sampled during Spring rotation

**Conclusion.** In summary, a total of 144 wells (as shown in Table 1) will be sampled during the upcoming Fall 2016 basewide groundwater monitoring event. Groundwater sample analysis will include 123 VOC samples (EPA Method 8260B), 3 cation samples, 3 TDS samples, 34 chloride samples, 34 nitrate samples, 34 sulfate samples, 34 alkalinity samples, 34 field test samples (hydrogen sulfide and ferrous iron), 21 dieldrin samples (OT071 and LF012), and corresponding QA samples (Table 1). All of the wells will be gauged for depth-to-water or depth-to-product. Gauging and groundwater monitoring will be performed in accordance with the Draft UFP-QAPP (Shaw, 2012a). Sampling results from the Fall 2016 groundwater monitoring event will be reported in the 2016 Basewide Annual Monitoring and Operations Report for CERCLA and Non-CERCLA Sites.

## **Tables**

Table 1 – Monitoring Well Summary, Fall 2016 Basewide Groundwater Monitoring Event

## **Figures**

Figure 1 – Upper Aquifer Wells to be Sampled, Fall 2016

Figure 2 – Lower Aquifer Wells to be Sampled, Fall 2016

## **References**

MWH, 2011, *Final 2010 Basewide Annual Monitoring and Operations Report for CERCLA and Non-CERCLA Sites, George Air Force Base, California*, August.

MWH, 2012, *Final 2011 Basewide Annual Monitoring and Operations Report for CERCLA and Non-CERCLA Sites, George Air Force Base, California*, August.

Shaw, 2013, *Final 2012 Basewide Annual Monitoring and Operations Report for CERCLA and Non-CERCLA Sites, George Air Force Base, California*, May.

Shaw, 2012a, *Draft Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) Quality Program Plan – Volume 1, Former George Air Force Base, Victorville, California*, August.



Table 1  
Monitoring Well Summary  
Fall 2016 Basewide Groundwater Monitoring Event  
Former George Air Force Base, California

Sampling Frequency				Associated Sites								Well Location		Depth to Water (ft bgs)		Free Product (ft bgs)		Screen Details		Prepared Pump Placement	Laboratory Analysis										Field Analysis				Rationale	
Monitoring Well	Spring	Fall	6-M	3-Meal	CO070	Z0031	DT069	LP007	LP012	LF014	LP044	ST067E	DT071	53054	59020	Aquifer	MLU	PL2	Spring 2016		Fall 2016	Interval (ft bgs)	Screen Depth (ft bgs)	82606	Cations	TDS	Cl	NO <sub>3</sub>	SO <sub>4</sub>	Alk	SiO <sub>2</sub> /H <sub>2</sub>	H <sub>2</sub> S	Fat <sup>2</sup>	Ar		CO <sub>2</sub>
NZ-93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	121.59	121.48	115-156	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, transmissive zone with highest contaminant concentrations or hydraulic conductivity, supports the monitoring of site hydrology	
NZ-97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	108.92	108.41	97-117	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well moved to Fall sampling schedule per BCT Workshop held in August 2014, plume boundary/compliance boundary category, supports monitoring of site hydrology	
NZ-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	217.08	217.99	226-246	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, plume boundary/compliance boundary	
NZ-99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	107.04	107.21	96-116	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well moved to Fall sampling schedule per BCT Workshop held in August 2014, plume boundary/compliance boundary	
NZ-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	155.55	138.93	168-190	-	-	-	-	-	-	-	-	-	-	-	-	-	Added in Fall 2015 - plume boundary/compliance boundary	
NZ-101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	103.93	103.34	91-111	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, plume boundary/compliance boundary category	
NZ-102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	103.55	103.52	96-116	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, transmissive zone with highest contaminant concentrations or hydraulic conductivity, confirms decay curve	
NZ-103	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.12	44.94	57-77	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, supports monitoring of site hydrology, confirms decay curve	
NZ-104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.66	102.68	117-137	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, plume boundary/compliance boundary	
NZ-105R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	157.97	159.00	170-190	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, area representative of contaminated and uncontaminated geochemical settings	
NZ-106	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	202.92	203.90	210-230	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, distal fringe portion of the plume, area representative of contaminated and uncontaminated geochemical settings	
NZ-107	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250.79	251.41	260-280	-	-	-	-	-	-	-	-	-	-	-	-	-	LTMP monitoring for landfill (Spring sampling), to be sampled in Fall too, transmissive zone with highest contaminant concentrations or hydraulic conductivity, general chemistry sample to assess movement from the upper to the lower aquifer	
NZ-108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	257.17	258.28	266-278	-	-	-	-	-	-	-	-	-	-	-	-	-	Added in Fall 2015 per a suggestion from the RWQCC consultant during a 9/22/2015 meeting on the DT071 site	
NZ-111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.87	116.70	100-140	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, area representative of contaminated/uncontaminated geochemical settings, confirms decay curve	
NZ-112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.200	-	190	-	-	-	-	-	-	-	-	-	-	-	-	-	LTMP monitoring for the landfill (only applies to Spring sampling), to be sampled in Fall too, plume boundary/compliance boundary	
NZ-113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	126.46	127.30	133-153	-	-	-	-	-	-	-	-	-	-	-	-	-	LTMP monitoring for the landfill (only applies to Spring sampling), to be sampled in Fall too, plume boundary/compliance boundary	
NZ-116	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	129.87	130.45	120-140	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, confirms decay curve	
NZ-119	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	166.91	166.81	148-169	-	-	-	-	-	-	-	-	-	-	-	-	-	ST0676 PSCAP compliance well	
NZ-121	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.28	26.94	76-94	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, confirms decay curve	
NZ-122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60.27	-	55-75	-	-	-	-	-	-	-	-	-	-	-	-	-	ST0676 PSCAP compliance well	
NZ-123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47.45	-	33-43	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, confirms decay curve	
NZ-125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	149.38	-	140 - 160	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, transmissive zone with highest contaminant concentrations or hydraulic conductivity	
NZ-126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	107.52	107.61	115-136	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, plume boundary/compliance boundary	
NZ-127b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	251.88	252.02	290-310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, plume boundary/compliance boundary
NZ-127c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	251.02	252.01	340-360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, plume boundary/compliance boundary
NZ-129b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	231.72	233.01	290-310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, area representative of contaminated and uncontaminated geochemical settings
NZ-129c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	231.65	232.98	320-340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OU-1 well scheduled for Fall sampling per BCT Workshop held in August 2014, area representative of contaminated and uncontaminated geochemical settings
NZ-130a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	154.98	155.176	165-185	-	-	-	-	-	-	-	-	-	-	-	-			

**Notes:**

- a - OT069 Subsite A
- b - OT059 Subsite B
- c - OT066 Subsite C
- d - OT069 Subsite D
- e - OT069 Subsite E
- f - OT069 Subsite F
- F - Fall

FP - Flood Plain Aquifer

Geo - Geochemical parameters include chloride, nitrate, sulfate, total dissolved solids.

Geo Extra - Additional geochemical parameters needed for geochemical evaluation may include total acidity, filtered major cations (calcium, magnesium, sodium, potassium), and field measurements of sulfide and ferrous iron.

L - Lower Aquifer

S - Spring

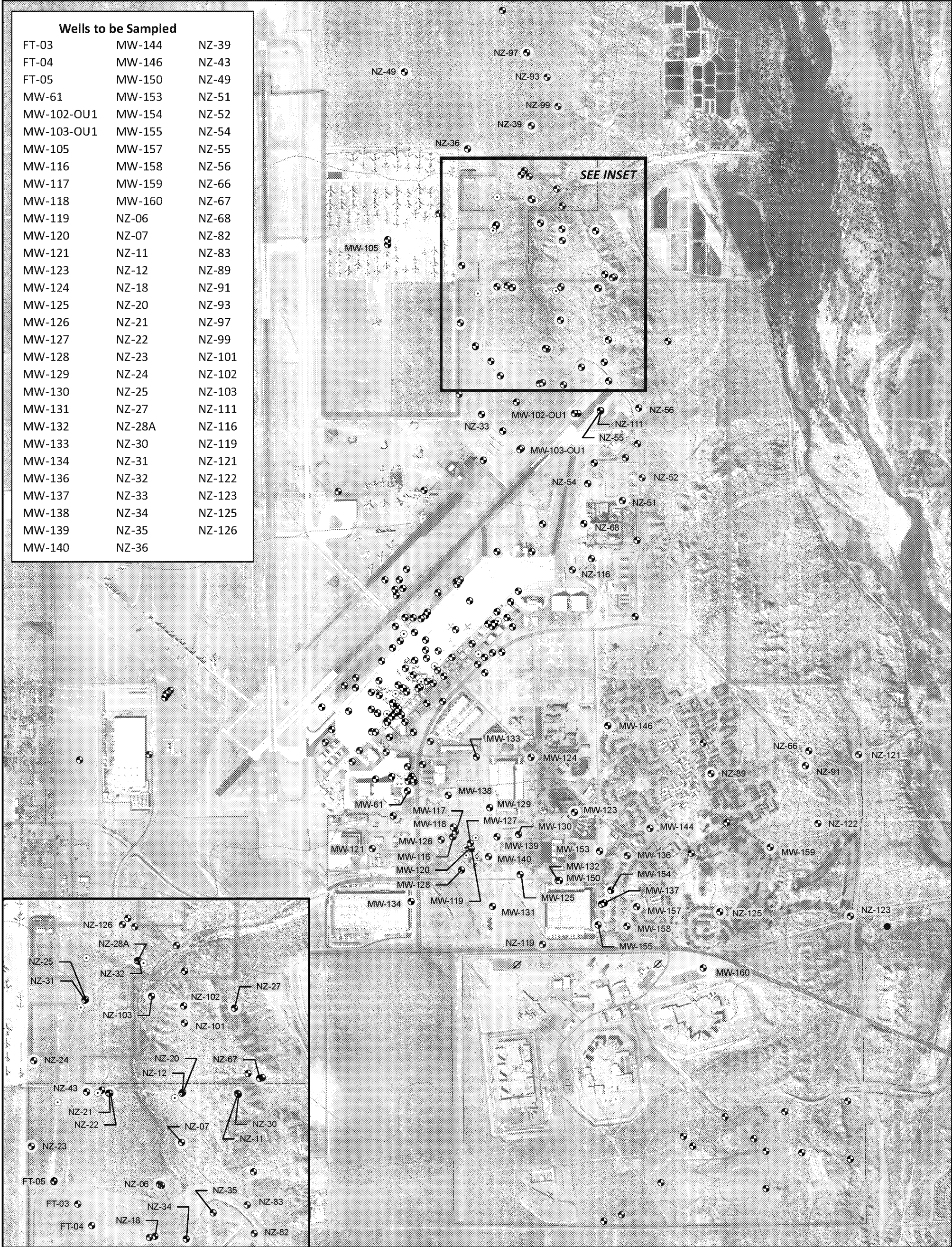
TCE - Trichloroethene

U - Upper Aquifer

VOCs - Volatile organic compounds

\* - Added as a One-Time Event during Fall 2016





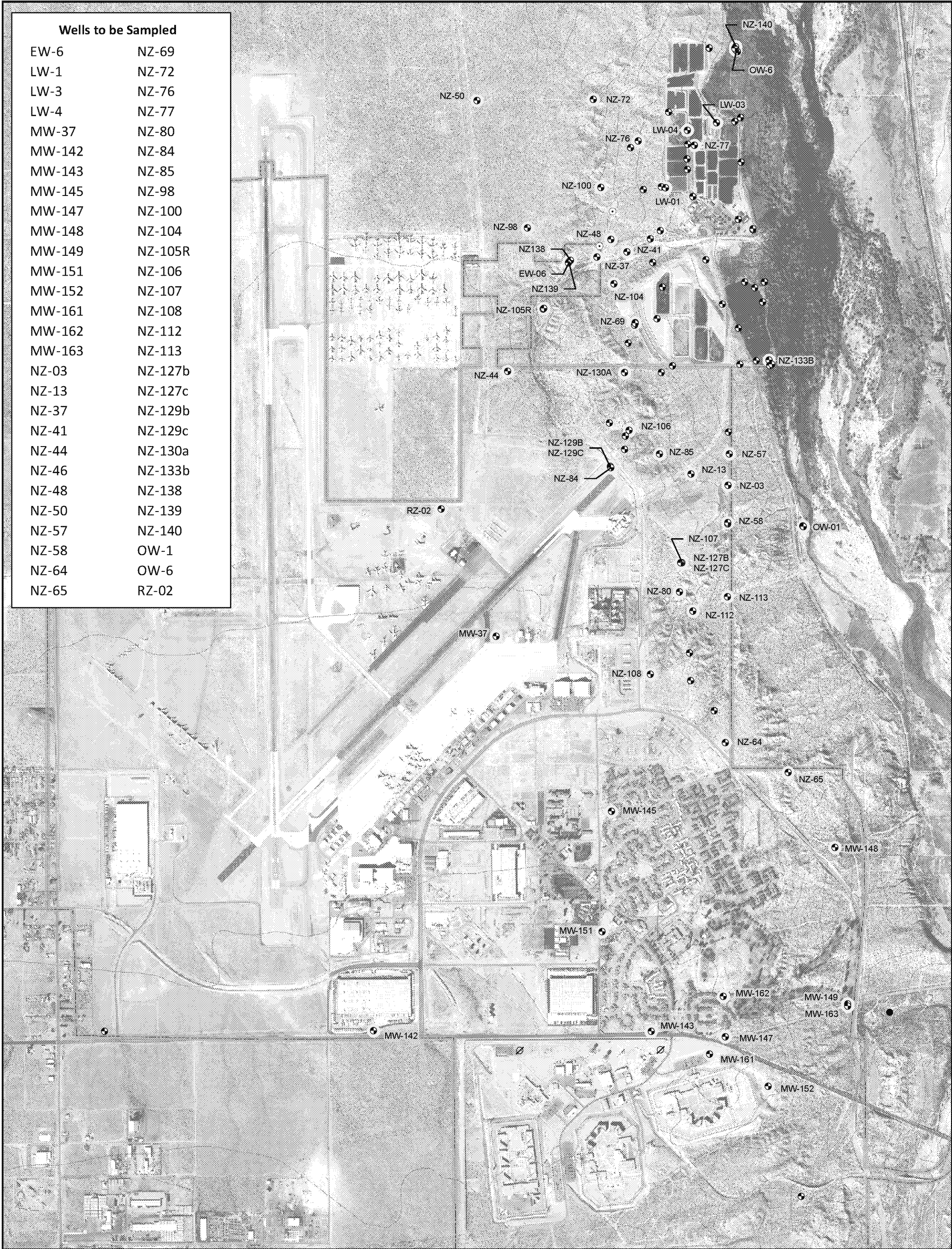
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2410 Cherahala Blvd  
Knoxville, TN 37932

FORMER GEORGE AIR FORCE BASE  
VICTORVILLE, CALIFORNIA

FIGURE 1

WELLS TO BE SAMPLED  
FALL 2016  
UPPER AQUIFER



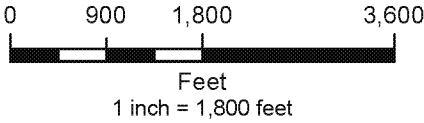


**Wells to be Sampled**

EW-6	NZ-69
LW-1	NZ-72
LW-3	NZ-76
LW-4	NZ-77
MW-37	NZ-80
MW-142	NZ-84
MW-143	NZ-85
MW-145	NZ-98
MW-147	NZ-100
MW-148	NZ-104
MW-149	NZ-105R
MW-151	NZ-106
MW-152	NZ-107
MW-161	NZ-108
MW-162	NZ-112
MW-163	NZ-113
NZ-03	NZ-127b
NZ-13	NZ-127c
NZ-37	NZ-129b
NZ-41	NZ-129c
NZ-44	NZ-130a
NZ-46	NZ-133b
NZ-48	NZ-138
NZ-50	NZ-139
NZ-57	NZ-140
NZ-58	OW-1
NZ-64	OW-6
NZ-65	RZ-02

**LEGEND**

- Free Product Extraction Well
- Groundwater Monitoring Well
- Water Supply Well
- ∅ Inactive Supply Well
- Well to be Sampled October 2016
- Topographic Contour (ft msl)
- ▭ Former George Air Force Base Boundary



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2410 Cherahala Blvd  
Knoxville, TN 37932

FORMER GEORGE AIR FORCE BASE  
VICTORVILLE, CALIFORNIA

FIGURE 2

WELLS TO BE SAMPLED  
FALL 2016  
LOWER AQUIFER